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A ROOT DISEASE OF PLANTATION RUBBER IN MALAYA DUE TO PORIA HYPOLATERITIA (BERK). (PRELIMINARY REPORT.)

By W. N. C. Belgrave.

Investigations have been in progress, since 1915, on a root disease of mature rubber trees—caused by a fungus—*Poria hypolateritia* (Berk). The work is not yet complete, but has progressed sufficiently to enable this preliminary account to be published.

Hitherto no disease due to species of Poria has been recognised as likely to cause serious damage to rubber plantations in Malaya, though the deaths of individual trees have been attributed to one species—*Poria vincta*.

P. hypolateritia is known in Ceylon as a root parasite of rubber and tea, but is apparently not a serious pest there.

The fungus was first isolated in the laboratory from the lower part of the bole of a diseased tree which was suffering from "wet-feet," *i.e.*, a rot[1] of the wood rendering it soft and moist or even slimy to the touch. Further work showed that the fungus was always present in the roots or bole (in the portion below the soil) of such trees in widely separated parts of the Peninsula, and further, that some of them occurred in situations which could never become water-logged.

The wetness of attacked wood, independent of situation, is a constant character of *Poria hypolateritia*—there are, however, some other symptoms which may or may not be present in any particular case.

(1) The rot caused by Ustulina Zonata is always dry and tendery.

(*a*) Sometimes delicate strands or patches of white mycelium are found on the exterior of diseased roots. The strands are readily distinguished from those of *Fomes* by their flatness and close adhesion to the surface. This mycelium is incapable of travelling through the soil.

(*b*) Brown lines or bands are sometimes present in the diseased wood. The bands are due to the secretion of wound gum, and the lines to the aggregation of hyphae into dark, hard masses of sclerotial tissue. These lines are superficially like those caused by *Ustulina zonata*, but are brown, not black, and finer.

P. hypolateritia has been found on jungle timber and stumps of both hard and soft woods; honeycombing of the former is frequent owing to the resistance of parts of the wood to the solvent action of the fungus.

The genus *Poria* is closely allied to *Fomes*, and the structure of the fructifications of fungi belonging to these genera is very similar. The fruit bodies of *P. hypolateritia* have no stalk and when fully formed grow partly on the wood and partly on the soil. On the under surface are numberless small circular pores, about the size of a pin's point, within which the spores are produced. The colour of the fructification is white when young, becoming red-brown and finally black when old. Fructifications have been found both on rubber and jungle wood, but they are comparatively rare, and are often imperfectly developed and sterile, *i.e.* bear no spores. They cannot be considered as active agents in the spread of this fungus on plantations.

The disease is spread by contact, first of a jungle stump or root with the laterals of a rubber tree, and thence to the roots of other rubber trees. It is especially dangerous because the subterranean habit unites with the very slow rate of progress to make detection difficult or impossible, until one of the diseased trees is blown over or dies; and when *P. hypolateritia* has been acting long enough to kill one tree, it may be taken as a certainty that some at least of the neighbouring trees are also diseased.

One plantation has been found to have its old rubber so badly infected with *P. hypolateritia* that no treatment can profitably be undertaken. So insidious is the disease that even after its presence was suspected, it could not be demonstrated till the soil had been extensively cleared from round and under the roots of the trees.

A tree badly attacked by *P. hypolateritia* will continue to look healthy and yield well because rarely more than two large laterals are affected, and the tree, except in very dry weather, can get

sufficient water and food materials from the remainder. Even after the fungus has reached the bole, it is for a long time confined to the heart wood, which has normally ceased to function as a conducting tissue; it is not until, owing to the weakening of the stem, the tree is blown over; or till the outer sap-wood is attacked, that the presence of the fungus is suspected.

While it is yet too early to speak with certainty, it seems probable that *P. hypolateritia* is *normally* among the fungi responsible for the rotting of the jungle stumps and roots. Should this prove to be the case, it will be necessary to assume its presence in all jungle-land; if this is further supported by a general occurrence of the fungus on rubber trees,[2] preventive measures would be indicated as part of the routine of every plantation. These would follow the lines indicated in Bull. No. 25 of this Department,[3]—p.p. 18 etseq. *i.e.* the adoption of a system of plant sanitation, as complete as the resources of the plantation allow. For young plantations and for plantations about to be opened up, clean clearing would be indicated as essential. If this operation is thoroughly carried out, immunity from attacks of *P. hypolateritia* is assured.

It is realised that pecuniary considerations may render it necessary to defer clean clearing till the property has reached producing stage, and while the same certainty of immunity cannot be attained, in the case of 4-6 year old rubber (since the fungus may have already entered the lateral roots), clean clearing at the time of thinning-out may be expected to have a beneficial effect on the incidence of the disease. This clearing should be accompanied by an examination, as thorough as practicable, of the trees which it is proposed to leave in.

While the application of the above measure at all plantations is conditional on *P. hypolateritia* being found to be generally distributed; they should at once be undertaken in those districts or areas in which the fungus is known to be present.

In old plantations in which the disease has taken a firm hold, it might be possible to save the healthy trees in a diseased area by trenching and cutting out the affected trees; but it is doubtful whether the outlay would be justified; owing to the risk of leaving some diseased roots behind, which would act as fresh centres of infection.

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(2) With a view to gathering information on this point, the author would be glad if Managers would inform the Department of any suspected cases.

(3) "Ustulina Zonata—A fungus affecting Hevea Brastliensis," A. Sharples.

The alternative is to dig a *deep* trench round infected fields, (deep drains serve the same purpose), and to tap the trees till they die; an event which may not take place for five or more years.

It may be taken as certain that if replanting is undertaken without complete clean clearing of the infected area, the supplies will develop the disease.

The author hopes later to publish a more detailed account of this disease.

THE DISTRIBUTION OF NITROGEN IN COAGULUM AND SERUM OF HEVEA LATEX ON COAGULATION WITH ACETIC ACID.

By B. J. Eaton and F. W. F. Day.

An investigation, the results of which are given in this paper, has been undertaken with a view to tracing the distribution of nitrogen between the coagulum and the serum, when coagulating Hevea latex with acetic acid, and also to follow the nitrogen content through the subsequent stages of manufacture of the coagulum, into sheet and crepe; and, the loss of nitrogen due to decomposition processes in the untreated (*i.e.* non-machined) coagulum, when left in this form over a considerable period, together with the loss of nitrogen, if any, in the serum when allowed to decompose.

The importance of this investigation will be realised from previous work carried out in our laboratories, in which it has been shewn that the rate of vulcanisation of Hevea rubber depends on the amount of some substance formed by the decomposition of the nitrogenous constituents of the latex, the maximum amount of which, *caeteris paribus,* is formed during the first six days after the rubber is coagulated, which may be described as the vital period in the life history of the rubber during its preparation, apart from any subsequent influences which may be brought to bear on the rubber.

Composition of latex:—The latex used for this experiment was diluted with water in the factory until its dry rubber content was 15 per cent or 1.5 lbs. per gallon, a standard dilution used in all our comparative experiments in the vulcanisation researches. One gallon of this latex was coagulated with 3 ozs. of a 5 per cent solution of acetic acid in narrow pans, the coagulum remaining in the serum overnight.

It was found that 100 parts by weight of latex yielded 67 parts of wet coagulum and 33 parts of serum, the coagulum being lifted from the pan and allowed to drain for a short time before weighing.

The following are the nitrogen contents of the various portions:—

	Nitrogen per cent by weight.
Latex	0.11
Wet coagulum ..	0.15
Serum	0.06

The nitrogen in the coagulum was determined on a fair sample, after lifting it from the pan, due account being taken of the disturbing effect of the serum squeezed out in cutting a small sample from the mass.

It will be seen that the figures for nitrogen in the latex, compared with those for the wet coagulum and serum, balance very closely, since a mixture of two parts by weight of wet coagulum containing 0.15 per cent nitrogen and one part by weight of serum containing 0.06 per cent of nitrogen would theoretically yield 3 parts by weight of latex containing 0.12 per cent of nitrogen as against 0.11 per cent found in the latex. This agreement is sufficient to verify the experimental figures.

Nitrogen content of serum:—The nitrogen content of the serum, which was contained in a tall cylinder covered by a watch glass, so that practically no loss due to evaporation of the serum took place, fell after 14 days to 0.04 per cent, and after 60 days the average figure was 0.03 per cent, after which no further loss appeared to take place.

Serum squeezed out of the coagulum in the process of making sheet had a rather higher specific gravity viz. 1.011 compared with 1.009 for that which drained from the unpressed coagulum. The nitrogen content of this serum was 0.07 per cent, slightly higher than that of the serum which drained from the unpressed coagulum.

Nitrogen in wet coagulum:—As stated above 100 parts by weight of latex yielded 67 parts by weight of unpressed coagulum or slab and this on hand rolling was reduced to 50 parts by weight containing 0.26 per cent of nitrogen equivalent to 0.78 per cent of nitrogen calculated on dry material. (*N.B.* The coagulum after standing six weeks was washed and creped and dried as crepe, and the moisture on the original coagulum estimated in this way—the loss of weight due to actual washing out of soluble substances, is too small on the weight of coagulum taken to affect the calculated nitrogenous figure (0.78%) for the dry coagulum.)

Nitrogen in partially dried coagulum:—The final weight of the hand rolled coagulum after six weeks represented 19.1 parts on the latex and the nitrogen content was 0.20 per cent or calculated on dry material 0.23 per cent, so that the nitrogen content of the coagulum has actually been reduced from 0.78 per cent to 0.23 per cent, a loss of more than two-thirds of its nitrogen, the greater part of which must have disappeared in a gaseous form, since the loss due to drainage of serum on contracting can be neglected. The six weeks' old slab, after washing and crepeing, represented 16.4 parts by weight of the latex as dried crepe and had a nitrogen content of 0.19 per cent. It will, therefore, be seen that only a comparatively small proportion of nitrogen has been lost during the washing and crepeing, *viz.* 0.23—0.19 = 0.04 per cent calculated on the rubber and that the greater part of the nitrogen in the slab has disappeared in a gaseous form; the loss due to crepeing by mechanical removal of the protein scale, which had dried on the surface, is small, although this scale has been shewn previously by one of us to consist of as much as 60 per cent of protein, calculated from the nitrogen content.

Nitrogen in sheet and crepe:—Samples of similar coagulum were converted direct to sheet and crepe on the day following coagulation with the following results:—

100 parts by weight of latex yielded 19.7 parts of wet sheet containing 0.30 per cent Nitrogen equivalent to 0.35 per cent calculated on dry weight, which on drying was reduced to 16.9 parts of sheet containing 0.38 per cent of Nitrogen.

Also, 100 parts by weight of latex yielded 21.3 parts of wet crepe containing 0.30 per cent of Nitrogen, equivalent to 0.38 per cent of Nitrogen calculated on dry material. This on drying was reduced to 16.9 parts of dry crepe containing 0.40 per cent of Nitrogen.

As will be seen, the nitrogen content of the dry sheet is only slightly lower than that of the dry crepe.

It will also be observed that the nitrogen content of the sheet and crepe is about twice as great as that of the coagulum left unpressed for a period of six weeks and then washed and creped, and nearly twice as great as that calculated for the dry coagulum after keeping, showing that little or no alteration of the nitrogenous constituents of the rubber has been effected in the sheet and crepe, causing the formation of nitrogenous substances soluble in water or gaseous loss of nitrogen in any form.

Distribution of nitrogen in partially dried coagulum:—It had been observed on cutting across old pieces of slab (*i.e.* unpressed or

lightly pressed coagulum), that the fungus which produces a blueish pigmentation, and which invariably develops on the freshly cut surfaces after a day or two, favoured more particularly the section lying close to but not actually under the dried skin.

A piece of old slab about 1 inch thick, showing this peculiarity, was cut in order to produce five sections, one being the dried skin and the others at equal intervals; number 5 section being that from the centre of the slab.

Nitrogen determinations on all these sections showed them to be identical, with the exception of the skin or dry layer, constituting about a depth of not more than 1/16th inch from the surface. This skin contained nearly three times as much nitrogen as the inner portions of the slab.

The following are the proportions of nitrogen found:—

	Nitrogen.
1st Section (Skin or outer layer)	0.32 per cent.
2nd „	0.10 „ „
3rd „	0.12 „ „
4th „	0.12 „ „
5th „ (central)	0.10 „ „

This is explained by the fact that drying takes place on or near the surface of the slab and that, in addition, much exuded serum has evaporated from the surface of the skin and so enriched the surface layer with an excessive quantity of dried serum containing a large proportion of nitrogenous substances; secondly, owing to the more rapid drying of the superficial layer, compared with the interior of the slab, a much smaller amount of the protein material is decomposed in this layer than in the layers beneath and, consequently, less nitrogen is lost from this layer.

It should be noted that the rough scales of dried serum which lie on the surface of a slab of rubber of this kind, were removed before analysis; if this has not been done the nitrogen content of this superficial layer would have been still higher.

PRELIMINARY NOTES ON CHENOPODIUM AMBROSIOIDES ANTHELMINTICUM.

By F. G. Spring and J. N. Milsum.

A small packet of Chenopodium seed was received from the Agricultural Experimental Station, Maryland, U. S. A., on the 13th

January, 1916, at the request of the Director of Agriculture F. M. S. This material was collected on the 2nd November 1915 at Arlington, Virginia, where it is stated to be a common weed.

The plant produces Worm seed oil which is becoming of considerable importance on account of its use in the treatment of the disease known as American Hook Worm or ankylostomiasis. An article appeared in the *Agricultural Bulletin,* F. M. S., Vol. IV, No. 8, page 247 dealing with the constituents and properties of the oil.

The seeds were sown in boxes of prepared soil in the latter part of the first week in February and were placed under shade and carefully watered. By the end of the month the seeds had germinated, the percentage of germination being estimated at between 80 and 90 per cent. In the first week of March the seedlings were transplanted into boxes which were kept under shade and given close attention as regards watering. When the seedlings had become established, the boxes were gradually moved in to the open and eventually exposed to full sunlight. By the end of March the young plants were about 2 inches in height and appeared to be sufficiently strong to permit of their being transplanted in to permanent quarters. Three nursery beds were then prepared for their reception, the soil being well changkolled and enriched by the addition of well rotted cattle manure. The seedlings were planted out in the nursery beds, at distances of 1 ft. apart, during the first week of April. Bamboo baskets were placed over the seedlings as a protection from the heavy rains and strong mid-day sun, the baskets were removed immediately the seedlings became established. Little further work was necessary beyond occasional watering and weeding. By the end of May the plants were showing signs of flowering and the first crop of seed was harvested during the second week of June. Towards the end of July the final crop was collected. The method of harvesting was to pull the plants bodily up and place them in trays exposed to the sun where the seed soon matured and was easily separated from the plants the following day.

A small quantity of the newly harvested seed was sown and an excellent percentage of germination obtained, the seed germinated in six days whereas that received from Maryland took three weeks to shew any signs of growth. It is satisfactory to note that, from the original half ounce of material received, 16 lbs. of seed have been harvested, and this is sufficient to plant up a good many acres.

It will be seen that a considerable amount of care and attention has been devoted to this the first crop but it is hoped that it may be

possible to grow Chenopodium successfully under ordinary estate conditions. A series of tests have been planned and are to be conducted on a larger scale with a view to finding out its suitability as a catch crop amongst rubber and coconuts, the results of which will be published at a later date. It is too early to say whether Chenopodium will be a success in Malaya and although it appears to be promising we must await the result of further experiment. Should the second crop prove as prolific as the first it is probable that the Department will be in a position to supply considerable quantities of seed to those interested in its cultivation.

"COAGULATEX," A NEW COAGULANT. PRELIMINARY NOTE.

By R. J. Eaton.

Owing to advertisements which have recently appeared in most of the local papers re "Coagulatex," which is recommended as superior to and more economical than Acetic Acid as a coagulant, samples of this coagulant were purchased and have been investigated recently in the Chemical Laboratory.

The Coagulant consists of a heavy yellow coloured liquid having a specific gravity of 1.4075 at 15°C. The coagulant was found to be strongly acid and on analysis was found to contain sulphuric and hydrochloric acids, the latter being present in small proportion only, together with a small percentage of some mineral constituent or salt.

The coagulant was found to consist essentially of sulphuric acid which is present to the extent of about 50 per cent by weight or 70 grammes per 100 cubic centimetres. The Hydrochloric acid present in the sample examined was 0.7 per cent, equivalent to about 2-3 per cent of ordinary concentrated Hydrochloric acid. (*N.B.* Concentrated Hydrochloric acid consists of an aqueous solution of Hydrochloric acid gas containing about 33 per cent of the gas). On evaporation a crystalline residue was obtained which on ignition amounted to 2.3 per cent and consisted of a white acid residue soluble in water (probably a bisulphate produced by the interaction of the sulphuric acid and the mineral constituents) with a small quantity of brown insoluble residue containing iron. The iron is probably present as an impurity in the acid. The mineral salts are being examined further.

"Coagulatex" as a coagulant:—The value of "Coagulatex" as a coagulant would depend almost entirely on the Sulphuric acid, since the other constituents, Hydrochloric acid and the mineral residue, would probably have little or no effect. In view of the results of this examination, the use of this coagulant is not recommended in the place of acetic acid, as it has already been stated in a previous bulletin that sulphuric acid is not a desirable coagulant compared with acetic acid. Secondly the price of "Coagulatex" compared with sulphuric acid on the local market is not favourable; the prices being compared on the basis of sulphuric acid content. The sulphuric acid content of a sample of imported sulphuric acid was 95 per cent by weight or 173 grammes per 100 ccs. Thus 1 gallon of "Coagulatex" costs $7/- (*N.B.* The price has been reduced recently by 20 per cent) while 1 gallon of sulphuric acid costs $4.13 so that the price per lb. calculated for equal weights of pure sulphuric acid in each coagulant is "Coagulatex" $1/- and Sulphuric acid 25 cents, *i.e.,* Coagulatex costs four times the price of sulphuric acid on a similar basis. No coagulation experiments have yet been carried out by me, but it can safely be stated that the coagulating power will be in proportion approximately to the sulphuric acid content.

Samples of rubber from estates are being examined; samples are also being prepared by me and will be vulcanised shortly and a further report published on the results obtained.

It is stated in the advertisment that "Coagulatex" contains no vegetable matter; the utility of this statement is somewhat doubtful as the absence of vegetable matter is by no means an advantage. Many vegetable acids, *e.g.,* citric, tartaric acids etc. are good coagulants, their chief drawback being cost. Acetic acid is an organic acid, *i.e.,* of vegetable origin, which is a decided advantage rather than a disadvantage, since an excess of such an acid is not likely to have such a deleterious effect on a substance like rubber, as mineral acids such as Sulphuric and Hydrochloric acids would have.

COFFEE IN JAVA.

In an instructive paper contributed to the *Philippine Agricultural Review,* Volume IX, No. 2, by P. J. Wester, gives an interesting account of the present position of Coffee cultivation in Java. The following notes are taken therefrom.

The failure of ordinary sanitation methods to combat the scourge brought about by "Coffee blight" resulted in an attempt to re-establish the industry by the introduction of immune varieties and a large number of species and varieties obtained from various parts of the world were tried. Two of these, *Coffea liberica* and *C. robusta,* attained great importance, the former appearing blight-resistant and being extensively planted, only however to be replaced by the latter when it was found that its immunity was but short lived.

For practical purposes we may divide the coffees now grown in Java into four classes:

(1) Arabian and related coffees.

These are now of very slight importance; they do well in a few favourable places but success is a matter of speculation. In the Philippines they are still grown at good profit.

(2) Liberica type including *C. liberica, C. excelsa* and *C. abeoculae.* Of these the first mentioned is the only one which has attained commercial importance. When first grown it was thought to be blight proof but of late it has succumbed to the ravages of the disease and has been almost abandoned. Under favourable conditions it yields 600-700 kilograms*[1] of berries per hectare*[2] and 10 kilograms of berries produce one kilogram of marketable produce.

C. excelsa. This is more drought and blight-resistant than *C. liberica,* doing well in higher elevations. It is an excellent stock for other coffees but gives slightly lower yield than *C. liberica.* Against this however 7-8 kilograms of berries produce one kilogram of coffee.

C. abeoculae. This stands between the two above-mentioned in vigour and susceptibility to disease but it is of better flavour. It yields less than *C. excelsa*: 8 kilograms of berries produce one kilogram of coffee.

(3) The Robusta type including *C. robusta, C. canephora, C. quillou* and *C. ugandae.*

The members of the whole group are approximately uniform in quality and market price, and represent the most successful stage in the re-established industry, *C. robusta* having attained greatest commercial importance of all.

As a group these coffees thrive up to 1,000 metres doing best at 450-700 metres, require abundant rain with 2 metres per annum the minimum, occurring in the season in such a way as to preclude prolonged drought.

*[1] 1 Kilogramme=2⅕ lbs.
* 1 hectare=2-47 acres.

They are more precocious than those of other groups bearing in three years at the rate of 1,000-2,000 kilograms per hectare.

The defect is that the coffee they produce is not so good in flavour as that produced by the members of the Liberica and Arabica group and therefore commands a lower price. 4-4.5 kilograms of the berry give one kilogram of coffee.

As concerns individual varieties in the group *C. robusta* by far the most dependable and should be planted 2.1-2.7 metres square.

C. quillou is a capricious variety which under favourable conditions may easily beat *C. robusta* but it is unreliable. It should be planted 2.7-3 metres square.

C. canephora differs from *C. robusta* in foliage characters and from practical utility can be considered its equal.

C. ugandae is the most blight-resistant member of the whole group. It is hardiest and is adapted to the most adverse conditions. It should be planted 2.1-2.6 metres.

(4) *Hybrids.* The various coffees hybridize readily and therefore many were found occurring spontaneously in Java. Many of these were tried but proved of little utility. Three however are worthy of cultivation. These are Kawisari B, Kawisari D and Kalimas all from *C. arabica* × *C. liberica.* They have so far proven almost immune, are of very strong growth and particularly hardy giving 500-600 kilograms per hectare of which 8.5 kilograms of berry produce one kilogram of coffee of excellent flavour.

These hybrids succeed under the same conditions as Liberica and Robusta, Kawisari D being best for low elevations and Kawisari B being best for elevations above 350 metres. They are grafted on Excelsa or Liberica stock.

The greatest difference dictating special manipulation between the old Arabian coffees and the new Hemileia-resistant types is, that whereas the former can be dried in the sun all members of the latter group require artificial drying in specially constructed drying houses in order to make possible the removal of the silverskin. Satisfactory drying houses are still in a state of evolution.

G. E. C.

COCONUT PESTS.

A preliminary report on the control of insect pests of coconuts by the Acting Government Entomologist has been printed. A small number of copies is available for distribution among persons connected with Coconut cultivation. Application should be made to the Director of Agriculture.

P. B. R.

NOTE.

The complete statistics of agricultural acreages, production, etc., for the whole of Malaya, which were not ready in time to be included in the Annual Report of the Director of Agriculture, are included in this issue.

L. L. B.

TABLE. I.

Agricultural Acreages, Federated Malay States, 1914 and 1915, excluding Padi and Horticulture from Estates over 100 acres in extent.

	Selangor.		Perak.		Negri Sembilan.		Pahang.		Total.	
	1914.	1915.	1914.	1915.	1914.	1915.	1914.	1915.	1914.	1915.
Coconuts.	23,030	21,352	31,566	29,495	1,054	1,483	2,377	2,492	58,027	54,822
Rubber.	205,907	211,704	164,052	166,248	90,422	109,723	10,669	11,804	471,050	499,479
Coffee.	6,200	3,656	1,700	632	15	9	75	15	7,990	4,312
Other cultivations.	1,854	780	909	238	1,016	211	Nil	5	3,779	1,234
Total.	236,991	237,492	198,227	196,613	92,507	111,426	13,121	14,316	540,846	559,847

TABLE II.

Agricultural Acreages, Malaya, 1915, from Estates over 100 acres in extent.

	Federated Malay States.	Straits Settlements	Johore.	Kelantan and Kedah.	Trengganu.	Grand Total.
Rubber Alone.	493,803	125,046	129,200	62,425	1,611	812 085
,, and coffee.	1,580	...	278	1,495	...	3,353
,, ,, coconuts.	1,323	273	45	780	1,000	3,421
,, with other crops.	2,773	4,215	1,873	5,349	...	14,210
Total.	499,479	129,534	131,396	70,049	2,611	833,069
Coconut alone.	53,207	22,530	1,576	17,561	7,606	102,480
,, and coffee.	1,297	130	...	...	...	1,427
,, with other crops exclusive of coffee.	318	453	45	640	...	1,456
Total.	54,822	23,113	1,621	18,201	7,606	105,363
Coffee alone.	1,435	...	...	...	...	1,435
,, with other crops.	2,877	130	278	1,495	...	4,780
Total.	4,312	130	278	1,495	...	6,215

TABLE III.

Rubber Statistics, Federated Malay States, up to 31st December, 1914 and 1915, from Estates over 100 acres in extent.

	Selangor		Perak		Negri Sembilan		Pahang		Total	
	1914.	1915.	1914	1915	1914	1915	1914	1915	1914	1915
No. of estates	305	324	333	365	155	166	24	31	817	886
Acreage in possession	358,379	359,160	296,669	317,997	154,228	209,321	22,456	30,123	831,732	916,601
Acreage planted up to 31st December, 1914 and 1915	205,907	211,704	164,052	166,248	90,422	109,723	10,669	11,804	471,050	499,479
Rubber alone	199,823	209,119	160,055	164,022	88,843	108,833	10,662	11,799	459,383	493,803
Rubber interplanted with catch-crop	6,084	2,555	3,997	2,226	1,579	890	7	5	11,667	5,676
Acreage producing	105,130	125,261	68,892	91,069	37,485	59,934	3,694	4,866	215,201	281,130
Planted during 1914 and 1915 ..	10,961	5,797	21,403	2,196	4,616	19,301	746	1,135	37,726	28,429

TABLE IV.

Rubber Statistics, Malaya, up to 31st December, 1914 and 1915, from Estates over 100 acres in extent.

	Federated Malay States.		Straits Settlements.		Johore.		Kelantan and Kedah.		Trengganu.		Total.	
	1914.	1915.	1914.	1915.	1914.	1915.	1914.	1915.	1914.	1915.	1914.	1915.
No. of estates ..	817	886	205	203	113	153	147	151	8	8	1,290	1,401
Acreage in possession	831,732	916,601	229,343	230,707	344,362	356,773	221,959	225,333	26,154	20,840	1,653,550	1,750,254
Acreage planted up to 31st December, 1914 and 1915 ..	471,050	499,479	127,960	129,534	121,559	131,396	60,649	70,049	1,802	2,611	783,020	833,069
Rubber alone ..	459,383	493,803	121,869	125,046	119,232	129,200	55,931	62,425	1,702	1,611	758,117	812,085
Rubber interplanted with catch-crop	11,667	5,676	6,091	4,488	2,327	2,196	4,718	7,624	100	1,000	24,903	20,984
Acreage producing	215,201	281,130	35,693	66,143	23,990	47,609	9,265	19,011	Nil	Nil	284,149	413,893
Planted during 1914 and 1915	37,726	28,429	6,807	1,574	2,486	9,837	3,697	9,400	2	809	50,718	50,049

TABLE V.

Comparative Table of Rubber, Crops, Malaya, 1906 to 1915.

State.	1906.		1907.		1908.		1909.		1910.		1911.		1912. a		1913. a		1914. a		1915. a	
	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.	Tons.	Cwt.
Selangor	276	16	504	19	824	6	1,641	5	3,148	13	5,106	14	7,482	6	10,110	15	12,601	6	16,061	11
Perak	42	7	121	16	171	—	473	9	1,322	8	2,697	4	4,116	18	6,623	17	8,959	7	12,112	1
Negri Sembilan ..	65	12	262	—	430	—	601	2	1,160	12	1,918	12	2,518	16	3,339	16	4,203	18	8,138	1
Pahang	..	..	..	..	..	..	..	..	† 1	2	13	18	74	14	155	9	337	19	548	13
Malacca	* 5	7	10	10	23	13	† 16	9	267	16	382	11	1,742	6	3,549	2	3,979	16	5,181	1
Province Wellesley ..	* 6	1	36	13	41	7	131	1	198	19	571	15	1,973	16	2,498	12	3,076	8	3,177	11
Johore	21	6	81	9	90	—	146	5	296	12	404	2	968	6	1,645	7	2,861	7	4,711	2
Kelantan and Kedah ..	..	..	..	..	..	..	..	..	18	11	23	..	79	6	246	18	1,383	18	1,955	0
Trengganu	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
TOTAL ..	417	9	1,017	7	1,580	6	3,909	11	6,414	13	11,117	16	18,956	8	28,169	16	37,403	19	51,885	0

In Province Wellesley are included thirty-six estates in Singapore, twenty-two estates in Penang and eight estates in Dindings.

* These figures are approximate.

† This is the figure returned, but the actual output was a good deal higher.

a Figures are from estates over 100 acres in extent.

TABLE VI.

Estate Labour, Federated Malay States, 1915, from estates over 100 acres in extent.

Race	Selangor	Perak	Negri Sembilan	Pahang	Total
Tamil men	46,012	39,056	7,913	1,283	94,264
„ women	13,518	9,994	1,831	142	25,485
„ children	5,038	2,657	629	36	8,360
Javanese men	1,796	2,861	1,600	663	6,920
„ women	154	1,658	177	299	2,288
Malays	645	5,591	1,558	286	8,080
Chinese	7,896	7,653	16,894	1,126	33,569
Others	288	846	247	48	1,429
Labour Total	75,347	70,316	30,849	3,883	180,395

TABLE VII.

Estate Labour, Malaya, 1915, from Estates over 100 acres in extent.

Race.	Federated Malay States	Straits Settlements	Johore	Kelantan and Kedah	Trengganu	Total.
Tamil men	94,264	16,026	7,778	5,092	18	123,178
,, women ...	25,485	3,913	1,265	1,157	...	31,820
,, children ...	8,360	719	356	256	...	9,691
Javanese men ...	6,920	2,929	4,547	1,178	10	15,584
,, women ...	2,288	725	612	38	...	3,663
Malays	8,080	7,135	1,897	7,588	3,567	28,267
Chinese	33,569	12,499	12,662	7,188	964	66,882
Others	1.429	113	632	177	2	2,353
Labour Total.	180,395	44,059	29,749	22,674	4,561	281,438

Comparative Returns of Imports, F. M. S., during the first quarters 1916 and 1915.

Articles	How counted	Selangor.		Perak.		Negri Sembilan.		Pahang.		1916 Total.		1915 Total	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Coconuts	Pikuls	...	$ 142	...	$ 214	...	$ 241	...	$ ...	...	$ 597	...	$ 73
Copra	,,	5	40	10	96	...	...	...	...	15	136	...	...
Coffee	,,	44	895	248¼	9,320	12	336	64	2,020	368¼	12,571	220½	5,623
Padi	,,	8,854	25,571	26,435	58,048	374	1,116	419	1,210	36,082	85,945	11,166½	31,802
Rice	,,	321,113	1,600,358	354,889	1,710,296	65,320	320,627	19,997	101,386	761,319	3,732,667	795,263	3,731,514
Pepper	,,	110	2,991	54	1,369	17	336	...	...	181	4,696	136¾	3,143
Sugar	,,	12,375½	121,925	34,341½	316,036	4,091	40,235	1,427	12,078	52,235	490,274	54,119½	403,838
Tapioca	,,	483	2,546	1,924	24,482	501	1,668	16	114	2,924	28,810	1,700	20,827
Gambier	,,	26	359	77½	1.791	12½	101	23	444	139	2,695	194¾	3,039

Comparative Returns of Exports, F. M. S., during the first quarters 1916 and 1915.

Articles	How counted.	Selangor.		Perak.		Negri Sembilan.		Pahang.		1916 Total.		1915 Total.	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
			$		$		$		$		$		$
Coconuts	Pikuls	...	...	...	139	...	28	...	14	...	181	...	675
Copra	,,	5,169	51,273	29,488	294,823	78	784	200	2,005	34,935	348,885	51,418	431,191
Coffee	,,	2,271	76,262	5	177	...	...	...	...	2,222	76,439	3,225½	80,115
Padi	,,	...	..	38,663	78,227	...	...	...	...	38,663	78,227	54,005	110,685
Rice	,,	...	...	13,125	61,407	...	...	...	...	13,125	61,407	46,848	207,672
Pepper	,,	2½	70	...	...	12	319	...	...	14½	389	44	788
Sugar	,,	...	823	11	160	...	...	...	...	11	983	...	37
Tapioca	,,	...	...	1,658	7,581	3,036½	19,148	2,513	15,078	7,207½	41,807	9,687	39,694
Gambier	,,	...	...	...	...	3,854	56,601	...	...	3,854	56,601	2,290	21,193

Exports of Rubber from British Malaya, (other than the F. M. S.)

State.	Month.	Quantity.
Johore	June, 1916.	lbs. 2,230,524
Kelantan	June, 1916.	
Kedah	June, 1916.	lbs. 462,355
Perlis	June, 1916.	lbs. 1,051
British N. Borneo	June, 1916.	lbs. 288,701
Brunei	June, 1916.	lbs. 10,027

FEDERATED MALAY STATES.

Comparative Statement of Cultivated Rubber Exported, with Value and Duty Collected Thereon, During the Years 1916 and 1915.

Destination.	Exported during June, 1916.	Previously.	Total export during the year.	Export during similar period of previous year.	Increase.	Decrease.	Value of rubber exported, 1916.	Duty collected, 1916, to date
	Tons.	Tons	Tons.	Tons.	Tons.	Tons.	$	$ c.
Straits Settlements	3,622.10	15,724.85	19,346.95	12,529.20	6,817.75	...	53,890,506	
United Kingdom ..	1,395 93	5,398.22	6,794.15	6,231.69	562.46	...	18,951,175	
Continent of Europe	...	...	...	8.00	...	8.00	...	
Ceylon	70.33	338.27	408.60	326.29	82.31	...	1,142,545	
Other Countries ...	26.11	516.38	542.49	95.07	447.42	...	1,463,725	
Total ..	5,114.47	21,977.72	27,092.19	19,190.25	7,909.94	8.00	75,447,951	1,964,853.98

KUALA LUMPUR,
8th July, 1916.

E. BURNSIDE,
Acting Commissioner, Trade and Customs, F.M.S.

Abstract of Meteorological Readings in the various Districts of Malaya for the month of June, 1916.

DISTRICT.	Mean Barometrical Pressure at 32° Fah.	Maximum in Sun.	TEMPERATURE.				HYGROMETER.				Prevailing Direction of Winds.	Total Rainfall.	Greatest Rainfall during 24 hours.
			Mean Dry Bulb.	Maximum.	Minimum.	Range	Mean Wet Bulb.	Vapour Tension.	Dew Point.	Humidity.			
Kelantan, Kota Bahru ...	...	134.	82.4	90.63	73.8	17.55	77.7	.854	74.5	77.	...	4.97	1.97
Pahang, Kuala Lipis ...	...	...	82.9	90.1	72.8	17.3	77.7	...	...	...	...	8.22	2.64
Johore, Johore Bahru ...	...	...	...	87.53	73.95	13.58	...	...	...	...	...	8.37	...
Singapore, Kandang Kerbau	29.752	154.5	83.0	88.5	75.2	13.3	78.2	.894	...	80.	...	8.61	1.78
Malacca, Durian Daun ...	29.799	148.5	85.8	87.3	71.4	15.9	79.2	.951	...	86.	...	.61	.36
Negri Sembilan, Seremban	...	154.5	79.4	87.9	71.4	16.5	75.3	.795	72.6	81.0	N.W.	6.02	1.32
,, Kuala Pilah ...	..	143.9	82.5	90.9	73.9	17.0	79.0	.924	76.6	82.9	...	4.67	1.50
,, Port Dickson	...	120 8	82.2	87.4	74.7	12.7	77.7	.861	75.6	78.4	...	3.22	.85
Selangor, Kuala Lumpur ...	29.742	142.2	81.6	88.5	74.6	13.9	76.2	.852	74.3	79.	N.W.	5.60	2.60
,, Klang ...	...	...	81.4	86.2	74.2	12.0	76.7	..	...	...	...	2.27	1.02
,, Kuala Selangor ...	...	.	...	89.0	75.3	13.7	...	...	...	...	...	1.88	1.71
,, Rawang ...	. .	...	...	94.5	...	...	...	...	...	.	...	1.65	1.20
Perak, Telok Anson ...	...	...	83.39	92.	71.	21.	78.19	.894	...	79.	...	1.70	1.16
,, Ipoh ...	...	...	83.16	95.	69.	26.	77.13	.851	74.92	75.	...	1.97	.39
,, Taiping ...	...	118.	83.36	95.	73.	22.	78.05	.890	...	79.	...	2.13	.58
,, The Cottage ...	...	...	..	...	. .	...	...	...	...	...	...	8.53	3.32
,, Parit Buntar ...	...	...	83.82	94.	72.	22.	78.48	.902	...	79.	...	.93	.53
Penang, Georgetown ...	29.750	142.	84.6	88.8	73.3	15.5	78.2	.886	...	75.	E.	3.13	.72
Kedah, Alor Star ...	...	...	...	...	...	...	...	...	...	...	...	5.15	1.57
Perlis, Perlis ...	...	...	...	88.60	74.20	14.40	...	...	...	.	...	4.23	...